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SPACE MARKET MODEL DEVELOPMENT PROJECT

Phase III Report

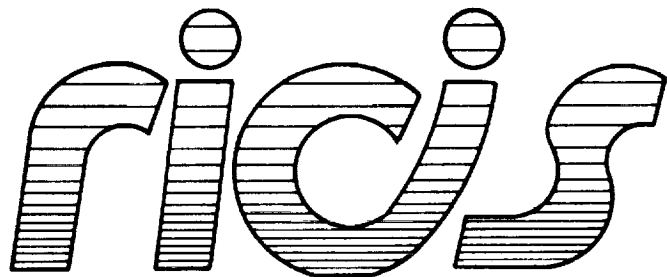
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University of Houston-Clear Lake

June 1989

**Cooperative Agreement NCC 9-16
Research Activity No. IM.1**



**Research Institute for Computing and Information Systems
University of Houston - Clear Lake**

T · E · C · H · N · I · C · A · L R · E · P · O · R · T

The RICIS Concept

The University of Houston-Clear Lake established the Research Institute for Computing and Information systems in 1986 to encourage NASA Johnson Space Center and local industry to actively support research in the computing and information sciences. As part of this endeavor, UH-Clear Lake proposed a partnership with JSC to jointly define and manage an integrated program of research in advanced data processing technology needed for JSC's main missions, including administrative, engineering and science responsibilities. JSC agreed and entered into a three-year cooperative agreement with UH-Clear Lake beginning in May, 1986, to jointly plan and execute such research through RICIS. Additionally, under Cooperative Agreement NCC 9-16, computing and educational facilities are shared by the two institutions to conduct the research.

The mission of RICIS is to conduct, coordinate and disseminate research on computing and information systems among researchers, sponsors and users from UH-Clear Lake, NASA/JSC, and other research organizations. Within UH-Clear Lake, the mission is being implemented through interdisciplinary involvement of faculty and students from each of the four schools: Business, Education, Human Sciences and Humanities, and Natural and Applied Sciences.

Other research organizations are involved via the "gateway" concept. UH-Clear Lake establishes relationships with other universities and research organizations, having common research interests, to provide additional sources of expertise to conduct needed research.

A major role of RICIS is to find the best match of sponsors, researchers and research objectives to advance knowledge in the computing and information sciences. Working jointly with NASA/JSC, RICIS advises on research needs, recommends principals for conducting the research, provides technical and administrative support to coordinate the research, and integrates technical results into the cooperative goals of UH-Clear Lake and NASA/JSC.

***SPACE MARKET MODEL
DEVELOPMENT PROJECT
Phase III Report***

Preface

This research was conducted under auspices of the Research Institute for Computing and Information Systems (RICIS) at the University of Houston-Clear Lake. RICIS is a cooperative research agreement between the NASA Johnson Space Center and the University of Houston-Clear Lake. Dr. Peter C. Bishop, Associate Professor in Human Sciences, directed the research, and Gary P. Hamel managed the Space Business Research Center.

Funding was provided by the National Aeronautics and Space Administration's Office of Commercial Programs and Space Station Utilization Office. Funding was administered through the Johnson Space Center under Cooperative Agreement NCC 9-16, Research Activity IM.1. The NASA technical monitors were Joseph P. Loftus, Jr., Kenneth Demel and Kyle Fairchild--all at NASA/JSC.

The views and conclusions contained in this report are those of the authors and should not be interpreted as representative of the official policies, either express or implied, of NASA or the United States Government.



SPACE MARKET MODEL DEVELOPMENT PROJECT

NASA CC 9-16 IM.1

Phase III Report

prepared for

National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Office of Commercial Programs
Space Station Utilization Office

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Space Business Research Center
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June 1989

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INTRODUCTION

This report describes the results of a research project investigating information needs for space commercialization. The project was born amid the decision by the Reagan administration that NASA add the commercialization of space to its mission.

Introduction of market forces into space activity produced uncertainty for NASA. NASA, with strong scientific and engineering expertise, was unclear about private sector information wants and needs. There was the possibility that a lack of business information would hinder mandated commercialization activity. The Space Market Model Development Project (SMMDP) was designed to help NASA identify the information needs of the business community and to explore means to meet those needs.

This document reviews the activity of the SMMDP and reports its operation via three sections. The first part contains a brief historical review of the project since inception. The next part reports results of Phase III, the most recent stage of activity. Finally, overall conclusions and observations based on the SMMDP research results are presented.

BACKGROUND

The major goal for the United States space program in the 1980's was the commercialization of space. Former President Reagan repeatedly stressed the importance of this goal. The President issued the National Space Policy on July 4, 1982 in which he directed that the U.S. government "expand United States private sector investment and involvement in civil space and space related activities." One of the principles of that same policy was that "the United States encourages domestic commercial exploitation of space capabilities, technology, and systems for national economic benefit."

The White House followed up the general policy with a specific directive on May 16, 1983 concerning the U.S. position on the use of commercial expendable launch vehicles. "The U.S. Government fully endorses and will facilitate the commercialization of U.S. Expendable Launch Vehicles." The President also issued a National Policy on the Commercial Use of Space one year later (July 20, 1984) designed to remove some of the economic and legal impediments to space commercialization as well as promote vigorous research and development in the area.

Not to be outdone, the Congress also amended the National Space Act of 1958 to include the commercialization of space as one of the specific objectives of the National Aeronautics and Space Administration:

The Congress declares that the general welfare of the United States requires that the National Aeronautics and Space Administration seek and encourage, to the maximum extent possible, the fullest commercial use of space. [42 US Code]

NASA itself accepted the direction from the President and the Congress and issued its own policy on the commercial development of space. That policy was implemented forming the Office of Commercial Programs at NASA Headquarters in Washington DC. Other major offices within NASA also took responsibility for implementing the commercialization policy, most notably the Customer Utilization Office within NASA's Space Station program. One of the initiatives outlined in the NASA Commercial Space Policy was that:

NASA would review its dissemination methods for science and technology data. With advice from industry, NASA will augment publications procedures to provide better support for the domestic private sector.

In response to this initiative, the Office of Commercial Programs and the Space Station Customer Utilization Office jointly funded the Space Market Model Development Project at the University of Houston-Clear Lake. The research project was designed to

study the information available about space commercialization and the additional information which the business community needed to fulfill its role in space.

The research was funded as an aspect of a newly formed cooperative agreement between the University of Houston-Clear Lake and the NASA/Johnson Space Center. The cooperative agreement, entitled the Research Institute for Computing and Information Systems (RICIS), was established to coordinate research into advanced computing and information systems. Continuing research into the development of the Ada programming language for the Space Station was the major focus. The Space Market Model represented research into applications-oriented information systems.

The Space Market Model Development Project was funded to investigate techniques for providing relevant business information to firms and agencies involved in the commercial development of space. The project is also intended to study ways of making optimum use of electronic information technology in providing such information.

The Project was officially funded by the Space Station Customer Utilization Office and the NASA Office of Commercial Programs on August 1, 1986. The Johnson Space Center was given the responsibility for managing and supporting the project for these offices.

The schedule for the Project called for a three-phase research program. Phase I was the definitional phase within which a number of research activities were conducted to

answer the following questions:

1. Who requires information about space commerce?
2. What information do they need?
3. How do they want to receive that information?
4. What information can be provided at reasonable cost?
5. What type of computer system is required?

Phase I thus established three overall goals to answer these questions:

1. To survey and collect business information used in the commercial development of space.
2. To study the information that the business community needed to support commercial ventures in space.
3. To design a mechanism for providing the required information in an effective manner.

PHASE I RESULTS

Phase I of the research project concluded in May 1987 and the report of that phase was published the following month. Phase I focused upon identifying business information resources and distribution channels for that information.

Existing information

The information currently available for space commercialization was analyzed through four prototype markets:

Space Shuttle small accommodation payloads
Remote sensing of land areas from space
Processing biological materials in space
Commercial launch vehicles

The results indicated that some types of information were readily available to participants in these markets. News about government agencies and major aerospace firms was abundant, as were the scientific and technical reports collected over 25 years of space exploration. On the other hand, lists of firms in various space markets and standard business statistics about those markets were less easy to obtain. In general, the information available reflected the fact that the market to date had been dominated by government R&D performed by a handful of major contractors rather than the more usual pattern of commercial firms working primarily within the private sector.

Information Aspirations

Desired information, information not readily available for space commercialization, was also identified. Interviews with individuals from different segments of space commercialization -- government officials, executives from aerospace firms, entrepreneurs, and business service professionals -- divulged the type of information they had as well as the information they needed to participate in an emerging space industry. All indicated a need for more information and for better access to the available information.

They rated directory information -- lists of firms in the market and their businesses' interests -- as the highest priority. Market statistics such as total product delivered, gross revenue, and market share were also needed for economic and investment analysis. Other respondents wanted to have a better idea of what government agencies had done and what they were planning to do in space. Also mentioned was a need for more information about international space programs. The interviews, therefore, complemented what the information analysis had shown--namely, the lack of business information which would be readily available in a mature market.

Bridging Information Resources and Desires

Could new business information be collected and distributed for the benefit of the whole industry? The types of business information selected for study were the economic relationships among various sectors of the space industry and between the space industry and the rest of the U.S. economy.

A team of economists evaluated the feasibility of using an input/output model to describe the flow of products and funds in the industry, and they found that indeed an input/output analysis would provide that information. Two approaches were considered: one which characterized only the market sectors internal to the space industry, another which integrated these sectors into the national I/O model.

The major problems with pursuing either approach were:

- 1) To correctly define the sectors to be described, and
- 2) To gather sufficiently accurate data to calculate the technical coefficients required by the model.

Another approach to the question of generating new information was to poll members of the industry on just what information they thought was necessary and what information they would be willing to divulge for aggregate economic analysis.

The remote sensing of land areas was chosen as the test market. A group of experienced advisors assisted the research staff in constructing a draft version of an economic census of the remote sensing business. This draft was then shared with industry representatives for their evaluation.

The feedback from the industry representatives indicated:

1. The goals of the census were quite ambitious at the time of the poll.
2. Most firms would have difficulty providing information on their purchases and sales in any detail.
3. The benefits to the firm for providing that information were difficult to describe, hence the final response rate might be low.

These results point out the problem of generating business information in a new industry. Many firms are small and privately held. They do not keep detailed records of their transactions and are reluctant to share those records when they have them. On the other hand, all respondents agreed that economic information was critical to the mature development of the industry. As a result, the Space Market Model Project concentrated on developing strategies to overcome the obstacles.

Space Business Information Center

In response to these results, the research team designed an information system to meet the need for business information about space. The goals of the information system were:

1. To provide better access to existing information about space commerce, and
2. To generate new information which the business community needs to do business in space.

The first step in implementing this plan was assembly and dissemination of existing information. Constructing and maintaining a dedicated repository of space commercialization data assumed the primary goal. Because of the magnitude of that task,

performing original research was delayed until the dedicated resources of the Center actually existed. A prototype of the resource information system was constructed and tested at a new research office of the University of Houston-Clear Lake called the Space Business Information Center (SBIC).

The Center's information system consisted of the following components:

- . A definition of the type of information to be handled
- . Procedures for acquiring and maintaining the information
- . Products and services delivered to the space industry

The type of information to be handled

The research showed that business information was required for the sound development of commercial space. Therefore, the planned information system concentrated on

- . space information rather than the more general category of aerospace information
- . business information rather than the more accessible scientific and technical information about space
- . information (factual data) rather than the more common set of plans, recommendations, proposals, or policy analyses distributed by space organizations

The other criteria for selecting information for this system was that the information not be readily accessible from other systems. The job of providing sufficient information to the space community was large enough without duplicating the efforts of existing organizations.

The information collected aimed to describe the core markets of space business along with the scientific, economic, political, and social contexts of those markets. Market information was defined to include the following types of information:

- Products and services
- People and organizations
- Contracts and agreements
- Budgets, expenditures, and revenues
- Recent events and future plans

The contextual information would contain the core information about, and monitor the developments in, the aspects of the society which have implications for the future of space business.

Information acquisition and maintenance

Early information was collected from available sources: the news media and periodical literature, government reports and publications, searches on electronic databases, and experts in the field. The information was stored as bulk documents in a library

format or as data elements in electronic databases. Information also was obtained on request from other information systems.

Information products and services

The prototype information system was available through the Space Business Information Center to a test panel of interested individuals and organizations during the middle of 1987. Members of the prototype panel were selected according to the following criteria:

1. Knowledge and experience in space commercialization
2. In-kind or financial contributions to the Center's ongoing research project
3. Willingness to provide periodic feedback on the Center's products and services

Panel members received information products and requested other information and studies from the Center in the normal course of their work in space commerce. They also provided the Center periodic feedback and guidance on the quality and delivery of the information products and services.

Defining, acquiring and maintaining information were thus identified as key operational procedures. The next step was to distinguish vehicle to disseminate that information.

The following general categories were targeted as potential information products and services for development:

1. Briefing books on various aspects of space business

The books would include factual data, lists of relevant organizations and individuals, official documents and regulations, and references for further information. These guides would serve as an introduction for business people interested in space business and as a reference handbook for those already involved.

2. Information clearinghouse

Panel members could request specific information as the need arises. Requests were received and information delivered via telephone, electronic mail, facsimile machine, and hardcopy delivery. A long-term goal was also to provide direct access to the electronic information which the Center would maintain.

3. Research reports

Some information requests would require primary data collection and/or analysis. These requests would be filled through separate contracts with the Center. Research studies would begin with a search for existing information within the Center's collection and move to primary data collection and analysis only where secondary sources are inadequate.

4. Briefings

The Center also will be able to present its information in a form suitable for face-to-face conferences and seminars. Briefings permit concentrated attention and extended interchange with experts on an aspect of space business. The briefing format is appropriate for clients who wish to become familiar with an area of space business in a short-time, concentrated period.

5. Custom information systems

Having developed the overall information system for space commercialization, the Center will be in a position to develop subsets of that system for individual clients.

The resulting system could be maintained by the Center for the client or by the client organization itself. Custom information systems are cost-effective for clients with large information needs or particular security requirements.

Phase I Conclusion

Phase I ended in May 1987 with its goals successfully met. Existing space business information was surveyed and collected; information needs to support commercial ventures in space were identified; a mechanism for providing the required information in an effective manner was designed and tested -- the Space Business Information Center. (See the bibliography at the end of this document for further information.)

The Center then prepared to begin its next phase of operation: opening its resources to the general public.

*PHASE II*Background

The second phase of the research project officially began in June 1987 and concluded at the end of April 1988. A detailed Phase II report was issued in June 1988.

The primary purpose of this stage was to evaluate the feasibility and effectiveness of the design conceived in the first phase. In short, the prototype Space Business Information Center tested the information requirements of space commercialization and addressed those desires and needs.

Phase II goals were:

1. To conduct a clearinghouse for space business information for members of the U. S. space industry – composed of public, private and academic sectors. Existing information, that could be accessed and did not require original research, was provided without charge. Statistics were compiled about the individuals who called and the types of requests they made.
2. To publish "business guidebooks" on major markets in space business. The markets selected were space transportation and the space-based remote sensing of land areas. The books are data-intensive reference works containing extensive facts and figures about these markets. Other types of publications were also to be produced as needs and opportunities were identified.
3. To conduct proprietary research and briefings for firms and agencies in the space industry.

PHASE II REVIEW

INFORMATION CLEARINGHOUSE

The information clearinghouse collected data in two ways. Behavioral statistics were recorded as requests were received and information was transmitted. These statistics indicate the nature of requests and the types of clients who made them. Evaluation statistics were obtained by contacting individuals who had received information and asking them to rate the Center on several criteria.

Two key conclusions emerged. The prototype Center successfully filled the majority of its clients' requests. Clients were satisfied both with the quality of the information they received and the promptness of its delivery. The number of repeat clients illustrates these findings.

The other conclusion, however, was that as many as one-third of the clients did not find the information useful. In those instances, either the Center overlooked some of the information which could have been sent, or the client expected more from the data than was possible.

In some cases, the Center did not send complete information for reasons of effectiveness and economy. One of the Center's initial assumptions was that clients needed information either because they had too little data, or too much. The Center's

goal was to offer "just the right amount of information" - the amount that could be easily assimilated and satisfy the client's need. In some cases, the estimate of the "right amount" was incorrect. Furthermore, the new operation understandably erred more on the side of economy than of surplus in allocating manpower.

In other cases, dissatisfaction was attributable to clients' expectations. Some clients already had all the published information available on a topic. Further information would have to be originated through expensive surveys or data analysis. In these cases, clients were not satisfied with the information they received because it did not increase their expertise. Client dissatisfaction was more prevalent among those already well versed in a subject area than among less knowledgeable clients.

Frequently, clients who had worked in a business area for some time would request data for their area. The information provided would be inadequate because the client knew the area better than the Center's staff did. This does not present a problem because the Center's strength lies in the breadth of its coverage rather than the depth. That breadth is more valuable for people entering a business than for those already established. The latter group usually considers its information sources adequate to its needs, and does not seek nor usually would be satisfied with information from other sources.

A clearinghouse for publicly available information needed government support to maintain operations. One of the findings of the Phase I research was that clients had

tremendous difficulty acquiring even publicly available data about space business. However, this finding was not substantiated by the Phase II operation. Many clients, after receiving the information they requested, indicated they already had it.

One way to serve these clients would be to change the type of information supplied to answer their requests by adding some analysis or interpretation. It is possible that even a small amount of value-added processing would make the information significantly more useful for these and other clients. However, analysis takes time and is expensive.

PUBLICATIONS

An information service represented one means of disseminating data to the business community -- publication was another. The Center continued to develop a set of printed materials for distribution during Phase III.

Business guides

Research continued on reference books on two space markets, the space transportation market and space-based remote sensing of land areas.

Space Business Briefs

These reports consisted of short analysis, backed by detailed information, about a topic of particular interest to the space business community.

Space Business Review

The Center worked on a prototype of a publication tailored to the needs and interests of the industry's major members as identified in Phase I and confirmed in Phase II: business service professionals, government officials and members of academe.

PROPRIETARY RESEARCH AND BRIEFINGS

Research contracts and briefings

Efforts to market the value-added services of the Center to the business community were disappointing. With one exception, the Center was unable to generate business community interest in focused research projects.

Much of the disinterest stemmed from the standstill in the space industry. In addition, the Center did not have the funds to develop and sell research services. NASA funds were disallowed for this purpose, and private sources were not forthcoming.

PHASE II CONCLUSIONS

The conclusions of the Phase II clearinghouse research were:

1. The business community was seeking information on the commercial uses of space.
2. The information most often sought was directory information, such as the names of firms in a particular market.
3. The information was sought by individuals in the business service sector more often than by people in other sectors of the space industry.
4. The Center was visible and accessible enough to support a steady flow of requests.
5. Clients received timely delivery of accurate information.
6. Some clients needed additional information requiring original research.

The prototype Space Business Information Center was an effective mechanism to provide information about space to the business community. The Center was accessible to a large number of clients, primarily from the business service community, who previously had little contact with the space program. The Center furnished them accurate introductory material on space business in a timely fashion.

On the other hand, the prototype Center was not rated highly by people already knowledgeable about space. For them, the information often was superficial and dated. Additionally, serious investors and entrepreneurs were reluctant to fund in-depth research due to the current low level of business activity in the industry. To address these concerns the Center's focus, and accordingly, name, changed. Activity shifted from collection and dissemination of secondary source information to research: value added analysis of that information. The Space Business Information Center (SBIC) became the Space Business Research Center (SBRC).

The Center positioned itself as a vehicle to reach one segment of the business community, the larger segment not yet adept in space business. The Center was viewed as one of several mechanisms which NASA and other government agencies use to support the business community in its quest for commercial ventures in space.

PHASE III

The activities of the previous phases helped identify the information needs and desires of clients. Phase III attempted to further determine the value of such information by gauging how much such information was worth. How would clients react to charges for information needs? How much, or little, would they pay? Indeed, would they pay at all?

Thus the three objectives identified in Phase II continued, but with altered emphasis. The goal was to stress activities that previous Phases had classified as most likely to produce revenue. Consequently research, adding more analysis in responses to information requests, shifted to the top priority; dissemination of research results, primarily via assorted publications, assumed a new urgency; and conducting proprietary research and briefings continued as an overall goal.

NASA and business community clients were allowed to continue to access the Center. Business clients would have to pay for their information and research. Charges were \$30 per hour for straightforward information services; \$60 per hour for adding analysis and interpretation to the unearthed information; and \$90 per hour for seminar and workshop presentations. NASA employees, media representatives, government employees, and academia clients were exempt from charges.

One way to demonstrate the effect of imposing charges is to review the level of activity during the life of the Center. The results of each Phase reveal themselves through measurements of activity over time. The official dates of the SMMDP Phases were:

Phase I -- August 1986 through May 1987

Phase II -- June 1987 through April 1988

Phase III -- June 1988 through May 1989

Though Phase II officially ended in April 1988, the actual institutionalization of fees did not begin until July 1988. Therefore, the following data review does not include May and June of 1988 -- both actually non-fee months.

INFORMATION CENTER

I. Level of Activity

As Chart I, "Activity by Month," reveals, SBRC remained an easily accessible and respected source of information about space businesses. However, the degree of activity shifted when fees were imposed.

. February 1987 to August 1987

Technically part of the Phase I fundamental research period, the contact rate climbed slowly in the Spring to almost 20 contacts in August, just before the formal prototype was opened in September.

. September 1987 to June 1988

The Phase II prototype began with a letter to our 250 person mailing list along with items in the media announcing the operation of the prototype. Information was provided free of charge. The number of contacts held steady at 20 and 30 contacts per month, despite the lack of further advertising throughout the period.

. July 1988 to May 1989

During the Phase III prototype business clients were charged for publications and research services. As predicted, the number of contacts dropped off to less than 10 per month after the July mailing which announced the charges. Part of that decline returned during the Fall 1988 quarter and activity continued at a steady, though reduced, pace.

CONCLUSION: The demand for an outreach-oriented Center helping NASA and assorted non-profit clients compile, analyze and distribute space business information reduced but remained steady. As the drop in activity in July 1988 demonstrated, almost all business clients were reluctant to pay for most space business information. Nonetheless, a steady level of demand for space business information certainly continued. Given the current reduced level of space commercialization activity, support from the Center's various types of clients will help determine its future activity.

Activity by Month (February 1987 - May 1989)

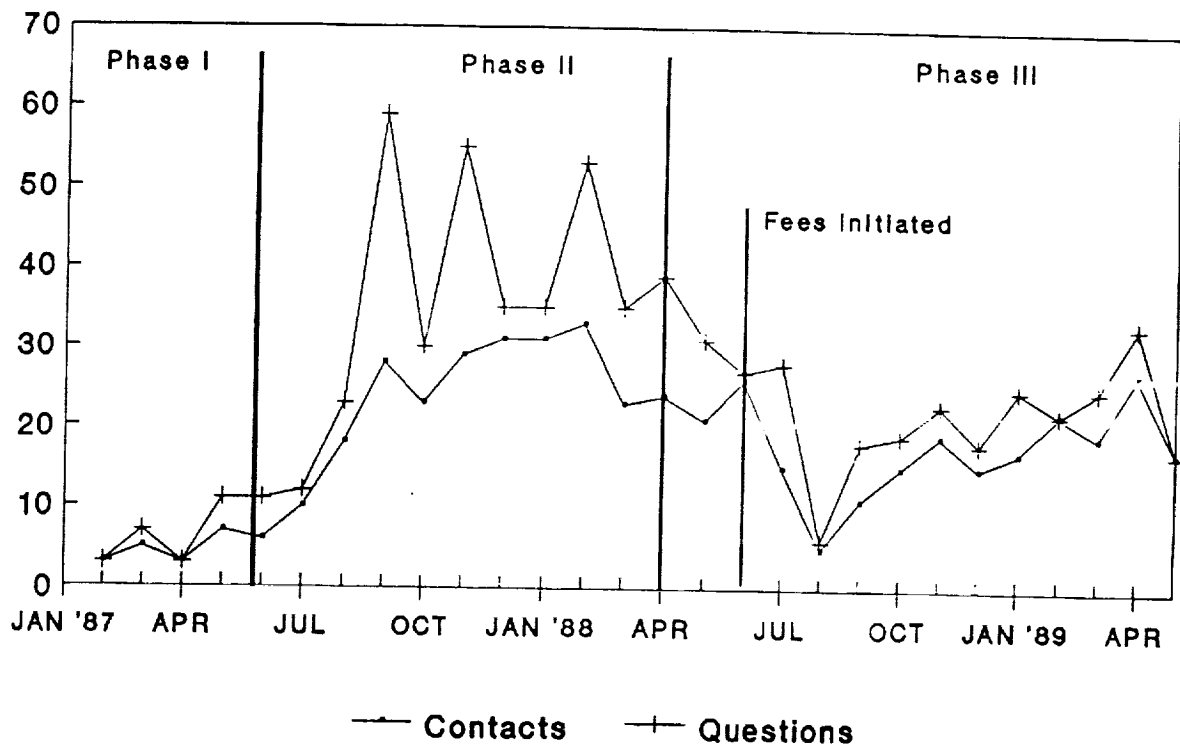


Table 1

Number of Contacts by Month

Month	Contacts	Questions
FEB87	3	3
MAR87	5	7
APR87	3	3
MAY87	7	11
Phase I Concludes		
JUN87	6	11
JUL87	10	12
AUG87	18	23
SEP87	28	59
OCT87	23	30
NOV87	29	55
DEC87	31	35
JAN88	31	35
FEB88	33	53
MAR88	23	35
APR88	24	39
Phase II Concludes		
MAY88	21	31
JUN88	26	27
Phase III Charges Initiated		
JUL88	15	28
AUG88	5	6
SEP88	11	18
OCT88	15	19
NOV88	19	23
DEC88	15	18
JAN89	17	25
FEB89	22	22
MAR89	19	25
APR89	27	33
MAY89	17	17
Phase III Concludes		
<u>Phase II Total</u>	321	469
<u>Phase III Total</u>	182	234
<u>Grand Total</u>	503	703

II. Types of Clients

Research during the previous phases demonstrated that certain segments of society saw a need for information about emerging space commercialization. Space commercialization attracted the attention of the business community as an arena promoted as an up-and-coming multi-billion dollar industry. The burst of inquiries during Phase II reflects this interest. The Challenger accident and subsequent multi-year delay in Shuttle launchings produced a backlog of payloads and sharply curtailed flight opportunities. Already overly optimistic forecasts became even less credible as the backlog continued. Seeing little potential for quick return, business interest cooled. The Center's research into the type of information businesses wanted and how much they were willing to pay for it demonstrated this decline in business client interest. The relatively low charges imposed by the Center did nothing to slow or reverse this deterioration in interest.

In this changed environment, the client pattern shifted. Three main movements occurred:

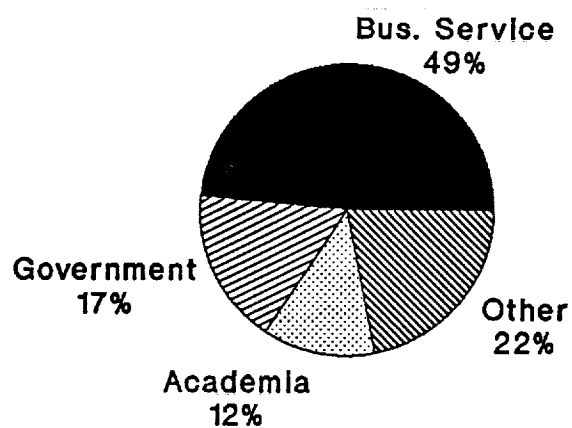
1. Business Service clients, previously the largest category, dropped to less than one quarter of the patrons when charges for those clients were imposed.
2. As the number of business service sector clients declined, government and academic clients proportionately increased. Government users increased from 17% to 24% and academic users increased from 13% to 33% during Phase III. Perhaps increased realization that space commercialization remains a very long-term research activity, combined with a new Federal administration possibly less committed to space commercialization, reflects this new pattern. Academics and governments,

lacking short term pressure from business investors, took advantage of the Center's resources to help support fundamental research and build infrastructure.

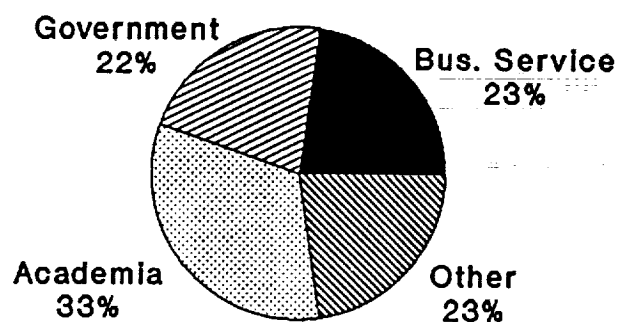
3. Aerospace companies, both the majors and the entrepreneurs, still did not constitute a significant user base. Together they represented only 10% of the clients. Phase III again demonstrated that people already conversant about space found secondary source space information recurrently superficial and dated.

CONCLUSION: Interest in future space commercialization remained. Yet few people pursuing the potential of space commercialization were prepared to pay for information about commercialization. Thus clients exempt from charges filled the arena formerly occupied by business. Aerospace corporations with in-house information resources saw little need to go outside for secondary information; cash short space entrepreneurs were unwilling to pay for information services. Serving this non-paying client base will require continued funding from the NASA offices charged with commercializing space activities.

Percent of Contacts by Client Category



No Fee Period
16 months, N = 321



Fee Period
11 months, N = 182

Table II

Number of Questions by Client Category
February 1987 - May 1989

Category	Previous Total through June 1988	Jul 88	Aug 88	Sep 88	Oct 88	Nov 88	Dec 88	Jan 89	Feb 89	Mar 89	Apr 89	May 89	Phase III Fee Period Total	Granc Total
Academia	40	2	2	1	2	5	5	7	13	7	12	4	60	100
Aerospace - large	17	1			1	2		1	2	7	2		9	26
Aerospace - small	21		1	2	2	2				2	1		10	31
Business Service	156	5	2	3	3	3	1	5	2	4	7	6	41	197
Government	55	7		4	5	2	7	4	5	4	3	3	44	99
Information	17			1		1							2	19
Media	8				2	4	2			2	1		11	19
Miscellaneous	7										1	4	5	12
Total	321	15	5	11	15	19	15	17	22	19	27	17	182	503
Academia	12%	13%	40%	9%	13%	26%	33%	41%	59%	36%	44%	24%	33%	20%
Aerospace - large	5%	7%	0%	0%	7%	11%	0%	6%	9%	0%	7%	0%	5%	5%
Aerospace - small	7%	0%	20%	18%	13%	11%	0%	0%	0%	11%	4%	0%	5%	6%
Business Service	49%	33%	40%	27%	21%	15%	0%	29%	9%	21%	26%	35%	23%	39%
Government	17%	47%	0%	37%	33%	11%	4%	24%	23%	21%	11%	17%	24%	20%
Information	5%	0%	0%	9%	0%	5%	0%	0%	0%	0%	0%	0%	1%	4%
Media	3%	0%	0%	0%	13%	21%	13%	0%	0%	11%	4%	0%	6%	4%
Miscellaneous	2%	0%	0%	0%	0%	0%	0%	0%	0%	0%	4%	24%	3%	2%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

III. Market Categories

What areas did clients think potentially profitable for space commercialization? Classifying the type of questions asked by activity or market helps provide an answer. The four private sector markets -- microgravity, remote sensing, satellite communications, and space transportation -- constituted the bulk of the market-related questions.

Space transportation represented the largest category with 34% of the requests through Phase II and 22% of the requests in Phase III, 30% overall. Such interest is not astonishing. The decision by the Federal Government not to rely solely on the Space Shuttle and to allow a private expendable launch vehicle industry to develop sparked much interest in this market area. Not surprisingly, Space Services, Inc. of Houston made the first successful commercial launch during this time span.

One market, satellite communications, is presently commercialized. As a profitable business, many services exist to support that industry's information requirements. The Center decided not to compete with those established operations. Still, 8% of Phase III questions and 9% of the Project's questions dealt with satellite communications. Obviously, moneymaking business attracts notice.

Remote sensing, with the LANDSAT and SPOT satellites, is another somewhat established market. Soviet attempts to sell their remote sensing images to the West added curiosity. Yet, as the continued uncertainty of U.S. funding for LANDSAT shows, future

remote sensing business remains ambivalent. Nine percent of Phase III and 14% of overall market questions concerned remote sensing.

Microgravity received closely the same amount of questions as remote sensing, 7% in Phase III and 11% overall -- down from 13% during previous phases. This drop probably suggests a realization by business services that microgravity remains largely a research market. Commercialization of the microgravity environment awaits future orbiting platforms and vehicles.

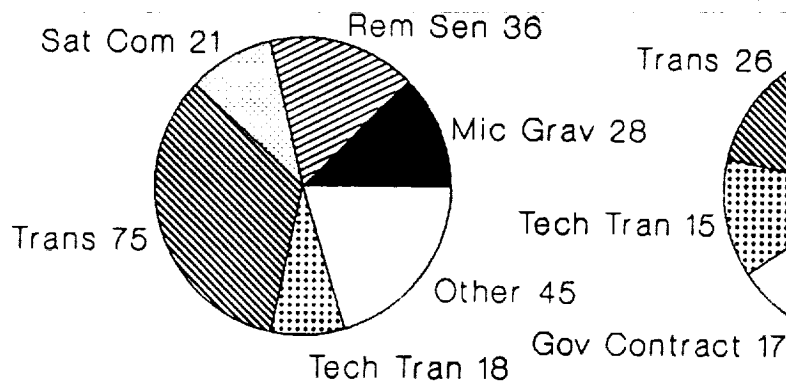
Interest in non-private markets -- technology transfer and government contracting -- surfaced as clients searched for opportunities attainable in an era of sparse flight opportunities. Technology transfer questions went from 8% in Phase II to 13% in Phase III. Government contracting, a market not even classified in previous activity, captured 15% of Phase III questions. Questions about space technology, 5% in Phase III, appeared as government and academic clients expanded.

CONCLUSION: Commercial space markets exist and are emerging. Satellite communications is an established market; space transportation an arising one. Yet most market activity remains in the future. The clients more actively investigating commercialization markets are typically those not constrained with immediate needs like stockholder demands for quick return on investment. It is the infrastructure builders -- academic and governmental people, along with the small entrepreneurs and non-profit

organizations -- that require information and analysis. Unfortunately, this group typically lacked the funds or the mandate to pay for data.

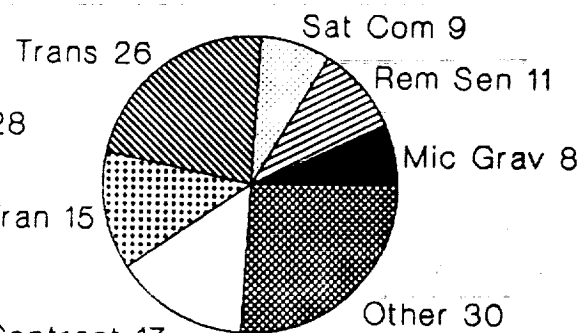
Questions by Market Category (February 1987 - May 1989)

No Fee Period



(16 months)

Fee Period



(11 months)

Table III

Number of Questions by Market Category
February 1987 - May 1989

Category	Previous Total through June 1988	Jul 88	Aug 88	Sep 88	Oct 88	Nov 88	Dec 88	Jan 89	Feb 89	Mar 89	Apr 89	May 89	Phase III Fee Period Total	Grand Total
Microgravity	28	1	1	2				1	1	1		1	8	36
Remote Sensing	36				2	1	1	2		2		3	11	47
Satellite Comm	21		1			4				1	3		9	30
Transportation	75		2	1	3	1		2	4	5	6	2	26	101
Space Station	15				1						2		3	18
Space Tech	0	3					2		1				6	6
Tech Trans	18	1			3		1	3	5		2		15	33
Govt Contract						3	3	3	2	2	2	2	17	17
SBRC	30				3	4	3			2	5	4	21	51
Total	223	5	4	3	12	13	10	11	13	13	20	12	116	339
Ada							2					1	3	3
Other - N/A	246	23	2	15	7	10	6	14	9	12	13	4	115	361
TOTAL QUESTIONS	469	28	6	18	19	23	18	25	22	25	33	17	234	703
Microgravity	13%	20%	25%	67%	0%	0%	0%	10%	8%	8%	0%	8%	7%	11%
Remote Sensing	16%	0%	0%	0%	17%	8%	10%	18%	0%	16%	0%	25%	9%	14%
Satellite Comm	9%	0%	25%	0%	0%	32%	0%	0%	0%	8%	15%	0%	8%	9%
Transportation	34%	0%	50%	33%	25%	8%	0%	18%	32%	36%	30%	17%	22%	30%
Space Station	7%	0%	0%	0%	8%	0%	0%	0%	0%	0%	10%	0%	3%	5%
Space Tech	0%	60%	0%	0%	0%	0%	20%	0%	8%	0%	0%	0%	5%	2%
Tech Trans	8%	20%	0%	0%	25%	0%	10%	27%	36%	0%	10%	0%	13%	9%
Govt Contract	0%	0%	0%	0%	0%	20%	30%	27%	16%	16%	10%	17%	15%	5%
SBRC	13%	0%	0%	0%	25%	32%	30%	0%	0%	16%	25%	33%	18%	15%
TOTAL	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

IV. Question Categories

Established businesses draw upon previous knowledge about contacts and markets to plan their strategic activities. However, even within well established business areas, demand exists for contact guides. Corporate directories like Standard & Poor's Register and Dun & Bradstreet's Million Dollar Directory represent a response to that demand.

Not surprisingly, in a new area like space commercialization the players and boundaries are especially uncertain. Hence directory information, "who does..." and "where can I..." type questions consistently remained the most common inquiries. Directory information represented 39% of Phase III requests, 38% overall.

Most of the other categories of information also maintained their relative importance, although changes did occur. The increased number of academic and governmental users probably caused the proportional rise in requests for documents (9% to 19%, 12% overall). Not unexpectedly, academics and government employees presume it natural to share public reports. Also, technology transfer, a new question category introduced, similarly reflected these two client groups.

The reduction in specific government contracting questions was likely caused by the diminished number of business clientele. Business people were generally less concerned about the conceptual than other groups. For instance, a person in an established space related business may question who is involved with a specific contract, an academic how

the contracting process works. However, space business entrepreneurs were interested in how the contracting process worked as well as who was involved with a specific contract. CONCLUSION: Directory information remained the top question category. Most of the other question categories of information maintained their relative importance. As fees for services were introduced, the client base shifted toward those exempt from charges. Thus the type of questions asked similarly shifted. Requests for copies of documents increased and interest in technology transfer started to materialize.

Questions by Category (February 1987 - May 1989)

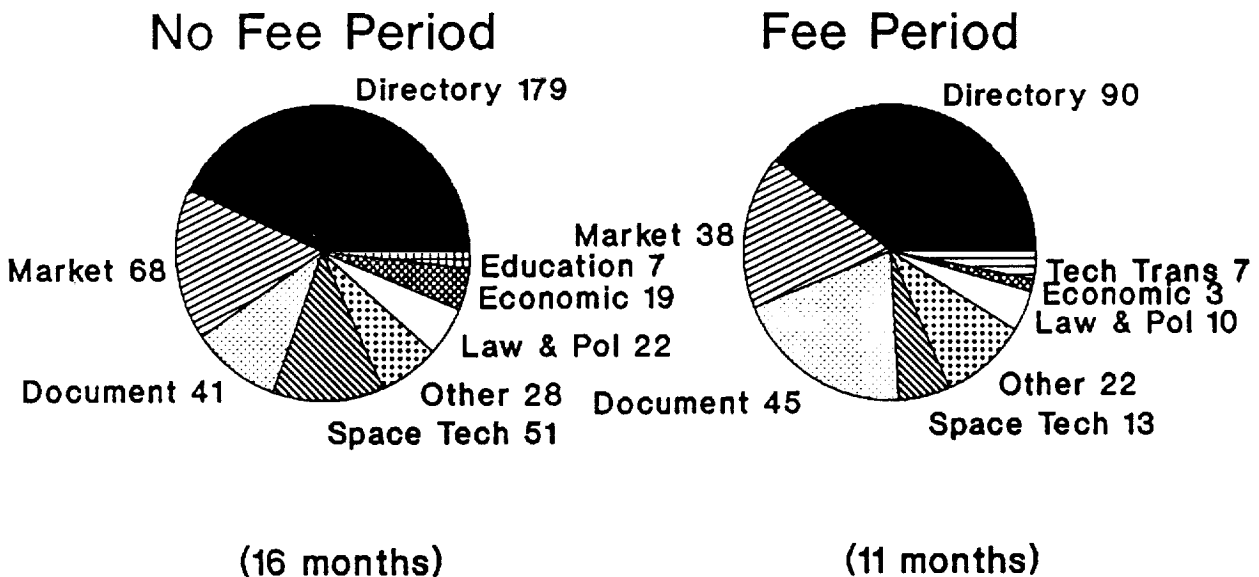


Table IV

Number of Questions by Question Category
February 1987 - May 1989

Category	Previous Total through June 1988	Jul 88	Aug 88	Sep 88	Oct 88	Nov 88	Dec 88	Jan 89	Feb 89	Mar 89	Apr 89	May 89	Phase III Fee Period Total	Grand Total
Directory	179	1	3	6	6	12	9	13	9	10	12	9	90	269
Document	41	14		8	5			3	3	3	5	4	45	86
Economic	19	3											3	22
Education	7												0	7
Govt Contract	54	2					1		1	1	1		6	60
Law & Policy	22	1			1	1	1	3	1	1	1		10	32
Market	68	6	2	3	4	5	3	2	1	5	5	2	38	106
Space Tech	51	1		1	3	1			2	3	1	1	13	64
Tech Trans	0					1				2	4		7	7
Other - N/A	28		1			3	4	4	5		4	1	22	50
Total	469	28	6	18	19	23	18	25	22	25	33	17	234	703
Directory	38%	4%	50%	33%	32%	53%	50%	52%	40%	40%	37%	53%	19%	38%
Document	9%	50%	0%	44%	26%	0%	0%	12%	13%	12%	15%	23%	19%	12%
Economic	4%	11%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	3%
Education	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%
Govt Contract	12%	7%	33%	0%	0%	0%	6%	0%	5%	4%	3%	0%	3%	9%
Law & Policy	5%	4%	0%	0%	5%	4%	6%	12%	5%	4%	3%	0%	4%	5%
Market	14%	20%	0%	17%	21%	22%	16%	8%	5%	20%	15%	12%	16%	15%
Space Tech	11%	4%	0%	6%	16%	4%	0%	0%	9%	12%	3%	6%	6%	9%
Tech Trans	0%	0%	0%	0%	0%	4%	0%	0%	0%	8%	12%	0%	3%	1%
Other - N/A	6%	0%	17%	0%	0%	13%	22%	16%	23%	0%	12%	6%	9%	7%
TOTAL	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

V. Revenue July 1988 - May 1989

Since the imposition of fees, approximately 6% of clients paid for the information they received. Total revenue generated by answering research questions was slightly over three thousand dollars.

Non-clearinghouse income came from another major Center activity since July 1988: publications. Publication revenue was almost five thousand dollars during the Phase III fee period.

CONCLUSION: People were reluctant to pay for information culled from secondary sources. Such data they could, if necessary, obtain through their own efforts. In an era where the overall commercial space industry did not grow, the relatively modest market served by the Center shrunk even more. Yet people would pay for such information if value were added. Indeed, the large aerospace corporations and others with the resources, like governments, frequently pay large sums of money for research and analysis. But the Center, located in a University -- a traditional source of free information -- could not compete with the full-scale consulting firms already serving those holding the resources. The Center, lacking the type of expert staff necessary to steadily produce proprietary research and analytic publications, was left serving those unable or unwilling to pay for its services. That information clearinghouse activity in itself is worthy and unquestionably supports the advance of space commercialization. But as demonstrated by the meager

level of income produced, without support from NASA or other interested sponsors, insufficient revenue exists to maintain the Center as currently configured once current NASA support expires.

A review of the publications activity of the Center during this time span helps reinforce this conclusion.

PUBLICATIONS

Besides an information service, publications were a vehicle used to distribute data to the business community. While the mission of an information service or a research center may appear ambiguous to some members of the public, a publication is easily understood and promoted.

Objectives stated during Phase II included the publishing of "business guidebooks" on major markets in space business. The markets selected were space transportation and the space-based remote sensing of land areas. Other types of publications were also to be produced as needs and opportunities were identified.

One identified need was a review of space business that classified and quantified its major markets. The Center released such a publication titled Space Business 1988. An Economic Profile of the U.S. Space Industry in September 1988. This \$30 document was widely received and favorably reviewed; its \$14.1 billion figure for the U.S. space industry

extensively reported. By the end of May 1989, 159 copies were sold, producing nearly \$4,800. At the same time, over 300 copies were distributed to government officials and media free of charge.

Work also continued on the guidebooks for remote sensing and space transportation. Unfortunately, the resources required to maintain and run an information clearinghouse and research center were not strong enough to allow simultaneous production and release of either document before May 1, 1989. As of late summer, the remote sensing document was complete and in final production mode; the space transportation manuscript still required additional research.

Other documents were also assembled. Examples of these short monographs included the impact of the Space Station on the Houston Economy (\$1.50) and possible alternative futures of satellite remote sensing (\$2.50).

Preliminary research for future publications was also performed. Draft papers on the National Aerospace Plane, advance launch boosters, and a comparison of the various state space initiatives were written. Data collection for a revised version of Space Business 1988 was initiated and compiled; research for a business guide to space manufacturing was achieved. A forecast of microgravity activities was nearing completion. The release date or price any of these upcoming documents would carry remains unclear.

CONCLUSION: Publications were a vital revenue producing vehicle. And people were willing to pay for documents like Space Business 1988. Very limited publication production brought in revenues in excess of the income generated by research activity. However, creation of quality publications required time-consuming research and endless editing. Getting documents past the research stage and into final production proved a formidable task given the level of experience and support available. The Center lacked the funding to hire the type of expert people required to complete intensive research projects such as book length publications. As a result, fewer documents than anticipated actually reached the public; those that did were well received.

Table 5

Research Revenue
July 1988 - May 1989

Month	Contacts	Questions	No charge	Charge	Research Revenue	Publication Revenue	Total Revenue
JUL88	9	15	6	3	\$775		\$775
AUG88	4	6	3	1	\$525	\$1,500	\$1,500
SEP88	11	18	9	2	\$85	\$1,650	\$2,720
OCT88	15	19	13	2	\$63	\$780	\$1,378
NOV88	19	23	18	1	\$30	\$300	\$330
DEC88	15	18	15	0	\$1504	\$90	\$90
JAN89	17	25	16	1	\$30	\$180	\$210
FEB89	22	22	22	0	\$0	\$82.50	\$82.50
MAR89	19	25	19	0	\$45	\$62.50	\$137.50
APR89	27	33	26	1	\$421.70	\$94.60	\$516.30
MAY89	17	17	17	0	\$30	\$135.00	\$165.00
Phase II	321	469	n/a	n/a			
Phase III	175	221	164	11	\$3508.70	\$4874.60	\$7904.30
Total	496	690	164	11	\$3508.70	\$4874.60	\$7904.30

PROPRIETARY RESEARCH AND BRIEFINGS

Research contracts and briefings

Efforts to market the value-added services of the Center to the business community were discouraging. With few exceptions, the Center was unable to generate interest from the business community for focused research projects.

One reason was the Center's broad agenda. Whereas a business focuses on one or a few specific services or products (such as, publishing a monthly document or holding regular seminars), the Center served a diverse clientele with widespread requests. A second reason was the competition for proprietary research. Large consulting groups with full time staff currently serve this market. The Center, operating the clearinghouse and conducting research for publication, lacked the resources to simultaneously develop and sell research services that were already available from private organizations. A third explanation involves the Center's inability to market its services. Not only are universities typically not used to marketing, the Center was not allowed to use Federal funds for that purpose. While not a problem for a free service, that restriction prevented the Center from achieving the necessary visibility in a competitive environment.

The lack of research contracts and briefings then resulted more from its public sector orientation than from its inability to deliver those services.

SPACE MARKET MODEL DEVELOPMENT PROJECT: Conclusion

The fundamental questions addressed in this research project are:

- What information do people need to do business in space?
- Does that information exist?
- Who needs the information?
- How much will it cost to provide? Will they pay for it?

The answers to these questions create the framework for the results of this project.

Two pieces of information stand out as most important throughout this study:

Who are my customers? -- directory information

How much money can I make? -- economic information

These two items are the fundamental basis of business -- selling products to customers for a profit. In most cases, firms already had a product, or an idea for one. They were looking for customers and for money -- the rest of the formula.

The second question was really the test of an hypothesis: Does sufficient information exist in the public domain to make a clearinghouse like the SBRC a worthwhile venture? On the one hand, selling or distributing information which is already

available does appear to be a valuable service -- certainly not one that a business would pay for. On the other hand, the Phase I results suggested that vast quantities of information did indeed exist, and yet firms did not know about it or they said it was difficult to obtain. It seemed therefore that a service which collected and disseminated such information would be valuable and perhaps even self-sufficient.

The clearinghouse operation, however, found otherwise. As the report makes clear, customers were sometimes disappointed with what the Center discovered in response to their queries. They either already had the information they requested or they could not readily use what they received.

The satisfied customers, those who needed such a service, tended to be those less familiar with the field. During Phases I and II, the business service sector were the best customers -- law, accounting, venture capital, public relations, advertising and market research. As business interest in space waned, however, the only businesses still interested were the small entrepreneurial start-ups, exactly the sector which needs the most help to break into the business.

The start-ups, however, had little money, and they were reluctant to spend it on information. The process of starting a business often did not include the best information available. Business people either made decisions based on their personal experience and their instincts or they developed the information on their own since they had more time

than money during the early phases of business. They had the money later in their development, but then the need for the information was less since they were more knowledgeable about the industry.

The established businesses were interested in material which would help them navigate and plan their future. They already had the data, but they were interested in the analysis of that data by a credible and reliable source. Therefore, they would spend large amounts of money on proprietary studies from traditional research firms. The Center was unable to respond to this need in an effective way during the time of the study. The director or other faculty were unable to develop in-depth industry analysis beyond Space Business 1988. Other staff members were students who were not prepared for such work. As a result, the Center could not compete with private firms who conducted such studies for a living.

Those who received the information for free were still lively customers during Phase III--news media, government employees, and academics. Students working on NASA research or developing theses and dissertations often traveled to Houston to, among other things, visit the SBRC library.

Thus, as predicted in the Phase I report, certain classes of customers needed a clearinghouse more than others did. They were either new to the business (like small entrepreneurs, government employees, or students) or they worked in many business areas

(like business service firms) and therefore had to keep up with events in all of those industries at once.

What the Phase I report did not predict, however, was the severe downturn in commercial interest during the study period. With business opportunities grinding to a halt and more people leaving the field than entering it, the remaining participants could keep up with events quite well through their normal activities supplemented by the media. That type of flat environment did not support the existence of a clearinghouse along the lines of the Space Business Research Center.

The Future

The space industry will soon leave the dust of the 1980s behind. Space commercialization was the primary rationale for going to space during the Reagan administration. Overly optimistic forecasts, high costs, dismal performance, and the Challenger accident all conspired to reduce interest in space business. Priorities for the space program are moving on -- a mission to planet earth, a lunar base, and beyond. The space industry as a government priority was born in the glare of media attention. It flourished for a time, but ultimately did not achieve its objectives in time for a fickle democracy not to shift its attention to other programs.

The light of media and government attention has faded, but that is actually a better environment for the growth of the real space business than the 1980s have been. Government action in the 1980s removed many of the obstacles to space business that existed in 1980. They made space business possible, but it is still up to the business people to make it a reality.

Real business is done outside the public eye. It is about putting money at risk in order to return a profit. That act is played out a million times a day across the world. It has become so commonplace that the news media rarely pays attention any more. But that is just the way the deal is made. It does not stand up to public scrutiny; it does not play well in Congressional hearing; it cannot abide by the Byzantine practices of government bureaucracy. So as the public image of space business fades, the real business of space begins: entrepreneurs seeking customers for products and services that involve the space environment.

The need for business information continues in that environment, but in a different way. Gone will be the media attention, gone the government's interest, perhaps even the academic interest will decline. Business people pursuing opportunities, however, will still need to find customers, estimate costs, and gauge returns. A reformed Space Business Research Center, with proper management and technical support, is still a viable possibility. Every mature industry has such a Center -- the scorekeeper, the commentator,

that group which monitors the industry and sells what it finds back to the industry participants. No one is offering that service today. It will exist in the mature space industry of the future. Some one will create it between now and then.

This study was a prelude to that venture, exploring the territory, describing the landscape. It did not create a viable and self-supporting Center. Perhaps it did lay the intellectual foundation for one. Only time will tell that tale...

APPENDIX I

MARKET CATEGORIES

SS: SPACE STATION
SC: SATELLITE COMMUNICATIONS
STR: SPACE TRANSPORTATION
RS: REMOTE SENSING
MG: MICROGRAVITY, INCLUDING BIOTECHNOLOGY
TT: TECHNOLOGY TRANSFER
GC: GOVERNMENT CONTRACTING
ST: SPACE TECHNOLOGY
SBRC: INTERNAL (WHAT DOES SBRC HAVE, "WHAT CAN YOU DO?")

APPENDIX II

CATEGORIES OF INFORMATION REQUESTS

(MS)	Market Studies	Applications of space technology, feasibility studies, market forecasting, market analysis
(GC)	Government Contracting	Status of existing contracts, RFP's and other procurements
(ST)	Space Technology	Physical infrastructure, launch vehicles, payloads, experiments
(EC)	Economic Studies	Macroeconomic and space industry analysis
(LP)	Law and Policy	Space law and impact of government policy; congressional activity
(DI)	Directory Information	Lists of names, addresses, phone numbers, etc.
(D)	Documents	Copies of publications
(E)	Education	Curriculum and course development
(TT)	Technology Transfer	Applications of technology from one market to another
(M)	Miscellaneous	Other

APPENDIX III
CATEGORIES OF USERS

Private Sector

Large Aerospace	Companies such as Boeing, Rockwell, Lockheed, etc.
Small Aerospace	Small start-up companies such as Space Services, Inc.; NASA contractors; and JSC Vendors. Small business contractors.
Business Services	Accounting, Architecture, Consulting, Insurance, Investment, Law, Marketing and Engineering.
Information Companies	Companies that sell information products and services to a mass market
Media	Press, print and video

Public Sector

Academia	Universities, students, libraries
Government	Agencies and departments, or personnel employed by federal, state or local entities.
Miscellaneous	Entities or individuals that do not fit in another category.

APPENDIX IV

Typical Clients and Requests

Typical Clients

Directory Information

- Architectural/design firm
- Consulting firm
- Forecasting consultants
- Public relations firm
- Large computer manufacturer
- Law firm
- Major remote sensing services firm
- NASA remote sensing CCDS
- NASA industrial application center
- NASA center commercialization office
- NASA commercialization contractor
- NASA remote sensing contractor
- NASA history contractor
- NASA engineers looking into forming a new business
- National space interest group
- Popular space magazine
- Real estate firm
- Small launch vehicle manufacturer
- Small communications company
- Space business consultant
- Space business roundtable
- Space industry analyst
- University library
- Video production studio

Typical Clients (continued)

Economic information

- Investment company
- Major metropolitan newspaper
- Metropolitan chamber of commerce
- NASA commercialization office
- NASA forecasting contractor
- NASA center space station utilization office
- NASA center budget office
- Office equipment manufacturer
- Space trade group
- State budget office
- U.S. Federal Reserve regional office
- Video production company

Educational information

- Elementary school
- University

Documents

- International space business consultant
- Law firm
- NASA commercialization contractor
- NASA center engineering contractor
- NASA commercialization office
- NASA center business study contractor
- University

Typical Clients (continued)

Market studies

- Communications company
- Government contracting resource center
- International remote sensing firm
- Law firm
- Major construction firm
- NASA center remote sensing contractor
- NASA history contractor
- NASA center analyst
- NASA commercialization office
- NASA center engineering contractor
- NASA commercialization contractor
- New space business company
- Public relations firm
- Space newsletter
- Space business roundtable
- University technology distribution office

Technology items

- Law firm
- Major international space magazine
- Major satellite manufacturer
- Small instrument company
- Small launch vehicle manufacturer
- Space business consultant
- University

Technology transfer

- NASA center executive
- NASA commercialization contractor
- Public relations firm

Typical Clients (continued)

Government contracting

Architectural firm
Engineering firm
Office automation firm

Typical Questions

Directory information

An address list of industrial launch companies

Directory information on all firms in Colorado who may be involved with the Space Station or other environmental control systems and heat radiators.

Newly industrialized countries that are looking at purchasing communication satellites

Information on E' Prime Aerospace of Titusville Fl

Information on Aerospace Systems International, located in Fl

List of GAS contractors

Information on a location JSC contractor

List of companies from the SBIR program

Sources of funds for space-type ventures

Sources of engineering support for space ventures

Individual in charge of venture fund for a specific Fortune 500 company.

Individuals in Houston who have started space firms

List of attorneys who do work in space business

Venture capital rating service

Typical Questions

Directory information (continued)

Firms producing space videos (educational film/space-related marketing)

Information on a specific Houston space firm

Lists of manufacturers in remote sensing -- space segment, ground segment, data processing equipment, and data interpretation services

List of Houston firms and organizations in space business

List of JSC contractors

Former NASA employees who have started successful businesses

Universities working with NASA on future of plants in space

Name and sponsor of Hawaiian launch site

List of companies that have active JEA's or working relationships with NASA

List of companies active in microgravity research -- their applications and a contact name

List of Industrial Applications Centers

List of Proton launches -- 1987 and 1988.

List of small U.S. launch companies and their types of service

List of firms who in work in automation and robotics, particularly those with Houston locations

Firms expected to relocate because of NASA space station program

Information on specific remote sensing firm

Typical Questions

Economic (continued)

Information on NASA's impact on regional development

Local taxes raised by NASA expenditures

The economic value of NASA technology transfer

GNP contribution of the space program over time

Size of aerospace industry in Texas

Education

Elementary school information about space

Procedures for NASA co-op program

Sources for a course on international space policy

Documents

How to obtain documents (Shuttle and Station) from JSC

1967 Outer Space Treaty

1987 OTA Workshop on news gathering from space

SBRC testimony to Texas Senate Space Science Commission

Long March Users Guide

NASA TR-2099 (Nov 86)

Charts and tables from The Soviet Year in Space, 1987

Soviet launch statistics from NASA Pocket Statistics

Typical Questions

Documents (continued)

NASA Procurement Annual FY87
Clear Lake Computer Capability Census

New York Times article (1/12/88) on Industrial Space Facility

Market Studies

Studies on the small payload market (500 - 1000 lbs.)

Current and emerging issues in space transportation

Costs of ground stations for recently launched communications satellites

Microgravity budgets of major space nations
Recent satellite communications revenues

5-year forecast of various space markets

Size of satellite communication industry

Military versus commercial space business

Pharmaceutical investments in space

Third world space applications (specifically Africa)

Assessment of likelihood of private launch facilities

Crop forecasting programs using satellite data

Payload pricing policy

Cost drivers of the remote sensing industry
Financial alternatives available

Typical Questions

Market Studies (continued)

Market forecast for satellites

Space market assessments being performed

Market for payloads less than 100 lbs.

Cost of launching mass to LEO

Prices charged by various launch companies now and for next 15 years

Ocean remote sensing system that give faster turnaround than Landsat

Market potential for Shuttle External Tanks

Space vs terrestrial production of gallium arsenide

Law & Policy

Positions of U.S. Presidential candidates

FCC regulations on radio licenses

Comparative space policy, especially European space activities

Relationship between launch customer and launch service provider

Technology Transfer

General information on NASA technology transfer

Successful NASA technology spinoffs

Literature on the process of technology transfer

Typical Questions

Technology Transfer (continued)

Cases of U.S. space technology transfer to Japan

Examples of reverse technology transfer from oil industry to NASA

Government Contracting

Process for submitting an unsolicited proposal to NASA

Procedures for obtaining engineering contract in stress analysis and materials engineering

Simulation contracts awarded by JSC

Sources for information packet on how to sell to NASA

REFERENCES

Space Market Model Development Project, Space Business Information Center. Phase I Final Report. June 1987.

Space Market Model Development Project, Space Business Research Center. Phase II Summary Report. June 1988.